EL SALVADOR

AGRICULTURAL SECTOR

12.

El Salvador Agricultural Sector

Old evaluation report number was 3.4.2 January, 1978

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I. DIAGNOSIS

General Information

Area (Km^2)	21.041
Population (million) - 1977	4.5
Density (inhabitants/Km^2)	214
Rural population percentage	59.8
Annual rate of population growth	
Average 1970-1976 (percentage)	3.5
Percentage of literacy - 1975	59.5
Gross National Product (1973 dollars-millions)	1.778.7
Per capita Gross National Product (1973 dollars)	433.0
Exports (US$-million) - 1975	516.0
Imports (US$-million) - 1975	554.3

Sources: Ministerio de Salud Publica y Asistencia Social "Memoria 1976-1977". El Salvador.
BID: "Progreso Económico y Social en América Latina". Informe 1976.

Importance of the Agricultural Sector

The importance of the agricultural sector in the Salvadoran economy can be measured by the magnitude of the following economic indicators:

- 28% participation in the gross national product.
- 74% of foreign exchange earned through exports.
- 53% of employment generated and more than 61% of the country's population dependent on agriculture for subsistence.

Rural Population Structure

The illustration shows the distribution of the rural population according to varying activities and to that percentage of the population dedicated to each:

Percentage Distribution of Land According to Farm Size

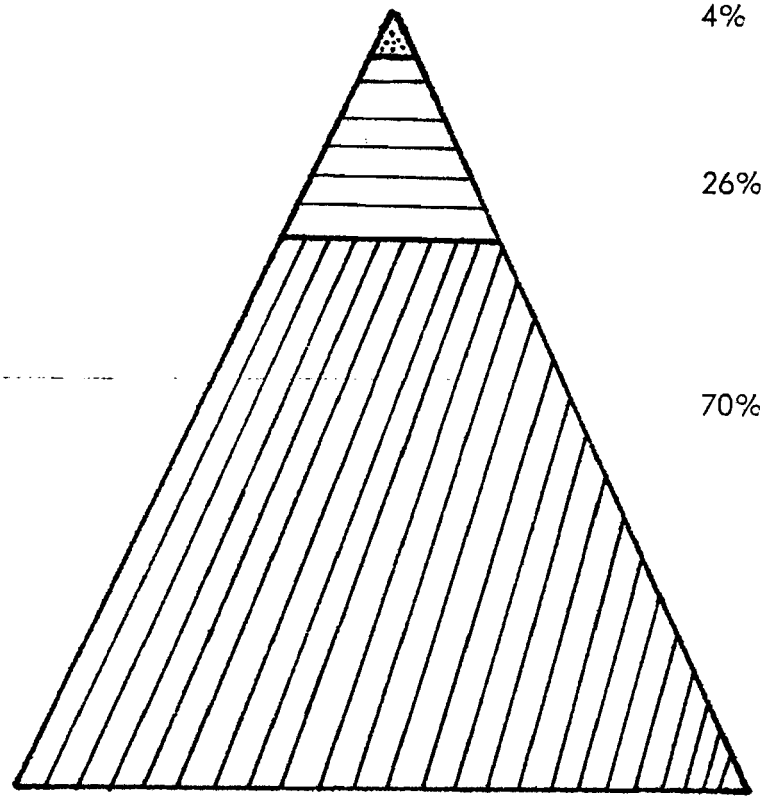
Type of Farm	% in Relation to Total No. Farms		% in Relation to Total Area	
Small farms (less than 1 hectare)	47.2	91.4	3.9	21.9
Subfamily farms (from 1 to 10 hectares)	44.2		18.0	
Family farms (from 10 to 50 hectares)	6.7		20.6	
Medium sized multifamily farms (from 50 to 200 hectares)	1.5	1.9	19.8	57.5
Large multifamily farms (over 200 hectares)	0.4		37.7	

Source: FAO/CEPAL/OIT/SIECA. "Tenencia de la Tierra y Desarrollo Rural en Centro América". 1975.

The preceeding chart is sufficiently clear in demonstrating the tremendous concentration of land in El Salvador, with 91.4% of all farms being of less than 10 hectares each and occupying 21.9% of the total land expanse, while 1.9% of the farms are of more than 50 hectares and occupy 57.5% of the total area.

In a study 1/ done by the Department of Regional Development in collaboration with the National Council of Planning and Economic Coordination (CONAPLAN) of the Government of El Salvador, property of less than five hectares was considered to be a small farm. These total 137,540 farms (80.4%), covering an area of 247.380 hectares (15.6%) of the total area in farms). The remainder,

1/ OEA. "El Salvador-Fase I - Zonificación Agrícola". Washington, D. C. 1974.



4% — Large landowners
Agrobusiness

26% — Medium sized farmers
Tenant Farmers
Merchants

70% — Small farmers
Peasants
Settlers
Day laborers
Craftsmen

that is to say, those farms of more than five hectares were considered as being for commercial use. Their number totals 33,580 (19.6%), extending over an area of 1,334,050 hectares (84.4%) of the land in farms).

Potential Land Use 1/

- Land suitable for intensive cultivation

  There are 383,645 hectares of land fit for intensive cultivation located mainly on the coastal alluvial plain and in the interior valleys. These include soil types I, II and III. Almost all of this land may be used for annual crops. Major crops suited to these areas are: cotton, sugar cane, corn, native sorghum, peanuts, soybeans, vegetables and beans. This is good or moderately good quality land and it is possible to use farm machinery and irrigation equipment.

- Land of limited suitability for intensive cultivation

  These lands include type IV soils and extend over an area of approximately 128,410 hectares. This is average or good quality land, not extremely suitable for intensive cultivation. Due to the slope of the land, danger or erosion and unfavorable soil characteristics, the selection of crops and farming techniques is largely restricted and/or requires that conservation and highly intensive corrective measures be put to use. The soils in this category may be used for annual or perennial crops and for stockbreeding. When used for cultivating corn and native sorghum, yields can not be sustained over long periods of time. Profitable yields may be obtained during years with an acceptable average amount of rainfall, while crops will fail in years of insufficient rainfall. The use of machinery is largely restricted due to the slope of the land and soil problems. Preparation of the land, planting and weeding are more easily accomplished by means of animal drawn equipment.

- Land suitable for perennial crops

  Located primarily in mountainous blocks, volcanic massifs and old volcanic chains, these lands include type VI soils and extend for approximately 385,000 hectares. These soils have the following limitations: extremely pronounced slopes, severe susceptibility to erosion, effects of past erosion, rocky terrain, very slight depth and low capacity for water retention. Due

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1/ OEA, op. cit.

to one or more limitation, these soils may not be used for intensive cultivation but may be adequate for pastures, perennial crops and growing trees suitable to the zone. Some of these soils are appropriate for special crops which require conditions (quality of soil, climate) different from the usual crops. Others soils may be used for some crops with a certain amount of freedom, provided that intensive management practices are applied. At altitudes of over 500 meters above sea level, one finds type VI soils fit for coffee, fruit trees, vegetables and flowers. Conservation measures must be right for the location and crops in question. The more important methods which must be used are: individual terraces, descending terraces, belt farming, contour farming, live fences and diversion canals.

- Land suitable for pastures and woods

These include soils types V, VI, VII and have a range of 1,189,975 hectares.

- Land of no agricultural value

These lands fall under soil types VIII. They occupy an expanse of almost 31,817 hectares of 1.51% of the country and are fit neither for crops nor for producing useful and permanent vegetation. Located in rough and rocky areas, this land includes marshes which are impossible to drain or recent lava deposits, outcroppings and volcanic cones. In short, these are areas where natural vegetation can not grow.

- Current Land use

According to the OAS study noted herein, the predominent characteristic of the Salvadoran agricultural sector is the lack of diversification in production. In the last few years, farming accounted to nearly 75% of the gross national product for this sector while stockbreeding, on the other hand, represents only 13%. Coffee, in turn, is the main agricultural crop, providing 40% of the gross national product for this sector. Cotton and corn follow in importance with 8.1% and 7.5% respectively for 1970. Together, these products comprise 55% of the gross national product for this sector. Coffee and cotton are export items while corn constitutes a product for domestic consumption.

Land Use (1961)

	% of Total Land in Use	
Total area under cultivation	44.0	
Temporary crops		33.2
Perennial crops		10.8
Total area in pastures	40.6	
Artificial pastures		7.0
Natural pastures		33.6
Area in woods and thickets	15.4	

Source: Secretarial General, OEA. "El Salvador. Fase I: Zonificación Agrícola". 1974.

Structure of the Cross National Product (1970)

	SECTORS	%
1.	Agriculture	27.22
2.	Mining and Quarries	0.14
3.	Manufacturing Industry	19.37
4.	Construction	2.72
5.	Electricity, water and sanitary services	1.47
6.	Transport, Storage and Communications	5.09
7.	Business	21.77
8.	Finance	2.24
9.	Home ownership	3.84
10.	Public Administration	7.73
11.	Personal Services	8.41
	TOTAL	100.00

SOURCE: OAS. "El Salvador - Fase I - Zonificación Agrícola". 1974.
1974.

Percentage Breakdown of the Gross National Product for the Agricultural Sector (1970)

	Percentages	
Agricultural Gross National Product	100.0	
1. Farming	75.5	
- Coffee		40.1
- Cotton		8.1
- Corn		7.5
- Fruits and vegetables		6.7
- Native sorghum		3.3
- Sugar Cane		2.7
- Beans		1.9
- Rice		1.8
- Others		3.4
2. Livestock	13.5	
3. Forestry	3.1	
4. Fishery	2.0	
5. Apiculture	0.1	
6. Poultry Farming	5.8	

Source: General Secretariat, OAS, "El Salvador. Fase I: Zonificación Agrícola". 1974

AREA, PRODUCTION AND YIELD FOR MAJOR CROPS - AGRICULTURAL YEAR 1976/77

PRODUCT		Area/Acres		PRODUCTION N°	Unit	Yield	
1.- Corn		334 500		7 444 100	Quintals	22.3	
2.- Native Sorghum		178 500		3 399 200	Quintals	19.0	
3.- Beans		75 540		870 100	Quintals	11.5	
4.- Rice		19 710		776 100	Unhusked Q.Q.	39.4	
5.- Cotton	*	113 300		3 965 500	Unbaled Q.Q.	35.0	
6.- Sugar cane	*	59 450	1/	3 188 600	Short tons	64.0	2/
7.- Cane for course brown sugar cane		12 140	3/	261 000	Short tons	21.5	
8.- Pineapple		2 300	4/	23 000	Metric tons	14.4	
9.- Bananas		3 720		9 300	Metric tons	2.5	
10.- Papayas		50		400 000	100 fruits	8000	
11.- Oranges		5 575		46 695	Metric tons	8.4	
12.- Coconuts		5 500		257 600	100 fruits	46.0	
13.- Watermelon		2 100		966 000	Quintals	460.0	
14.- Tomatoe		1 460		11 680	Metric tons	8.0	
15.- Cassava		1 900		273 600	Quintals	144.0	
16.- Red Pepper		225		21 375	Quintals	95.0	
17.- Sesame seed	*	6 025		61 970	Quintals	10.3	
18.- Peanuts	*	640		9 105	Quintals	14.2	
19.- Tobacco	*	2 020		48 900	Quintals	24.2	
20.- Henequen	*	12 450	5/	115 360	QQ Fiber	12.8	
21.- Kenaf (ambary)	*	2 114		30 943	QQ Fiber	14.6	

1/ Includes 9,900 sq. acres under cultivation.
2/ Yield reported by mills was 55 short tons per 1.75 acres.
3/ It is estimated that the 1975/76 figure will be maintained.
4/ Estimated to include 700 sq. acres under cultivation.
5/ Includes 3,450 sq. acres under cultivation.

Source: Encuesta de Propósitos Múltiples. October 1976, Dirección General de Economía Agropecuaria, Ministerio de Agricultura y Ganadería.

* Specific surveys.

Major Products Constituting the Diet in El Salvador

The consumption of basic grains such a corn, native sorghum, rice and beans is the outstanding feature of the Salvadoran diet.

70% of the small and medium sized farmers are dedicated to producing these crops. This production, which corresponds to the most underdeveloped type of farming, is characterized by a lesser use of fertilizers, the use of inferior quality seeds and the lowest of yields.

Production of these grains is dispersed throughout the entire country. Though there are ecological zones where greater yields are produced these do not necessarily coincide with actual production areas.

Several Characteristics of the Crops Mentioned 1/

- Corn: This has been the basic grain most subjected to importation. Its growth has been practically constant although between 1965 and 1967 there were sizable declines in production due to climatic factors. In 1965, for example, it was necessary to import 1,623,362 quintals of corn. However, imports have decreased to the extent that harvests have improved.

  The development of this crop has encountered obstacles of a diverse nature. This is a product which is grown, to a great extent, by small tenant farmers who do not make use of modern techniques. Though lately, through the iniciative of an agricultural extension program of the Ministry of Agriculture and Livestock, this situation has improved.

  Other negative factors concerning corn production are a lack of credit for the small farmer, a situation which has been remedied in part, thanks to the establishment of farm credit; and extreme fluctuations in prices which make it impossible to guarantee the farmer reasonable profits.

- Native Sorghum: In practice there are no specialized growing zones for this product. Like corn, it is fundamental to the diet of the population and is planted on almost all farms. However, it can be said that the bulk of total production comes from the coastal area of the country.

1/ OEA, Op. cit.

- Rice: The development of this crop has had special characteristics. At the beginning of the 1960's it was generally grown only by the small farmer. However, as of 1963, rice began to be cultivated by big farmers who, moreover, developed a series of research in order to obtain production varieties with greater resistance to plagues. From then on, rice production underwent a rapid rise in development which lasted until 1968, when problems arose in the external market. Problems arose for two reasons. The first of these was due to the undoubtedly unpredictable fact that rice from El Salvador was not acceptable on the world market because the varieties obtained did not meet established standard (there was a large percentage of broken grains after processing). Secondly, production costs were very high.

  Rice is grown mainly in the coastal areas; in the lower section of the Departments of Ahuachapan, Sonsonate, La Paz, Usulutan, San Miguel and La Union; in the middle and lower regions of San Vicente and Santa Ana; and in the southern part of La Paz. It also grows in some parts of La Libertad and Chalatenango, and in the northern part of San Salvador, Cuscatlan and Ahuachapan.

- Beans: The principle problem presented by this crop lies in a lack of adequate research aimed at its improvement. Local varieties are highly subject to fungus, thus giving rise to the need for incorporating varieties resistant to these diseases. During the latter part of the decade under consideration, varieties were obtained which permitted an improved growth in production. Production volume reached 670,000 quintals in 1970, some 17.3% above the harvest of the previous year. However, the domestic consumption of beans still makes importation necessary despite an appreciable growth in local production. As in the case of corn, the increase in bean production is due to success achieved in reasearch and in the protection of this crop; as well as to the availability of land, financial assistance and price guarantees for growers. The largest cultivations are found in the central regions of the country. A major portion of regional production is concentrated in the Department of La Libertad with productivity being above the national average. The Department of Santa Ana is the country's main individual grower.

Major Export Products

In the export of commodities, three products stand out: coffee, cotton and sugar cane. The development of products destined for export is usually characterized by greater mechanization and capital expenditure, and by a high

rate of productivity. Reference must be made to the production of coffee. Here a large sector of small farm owners are involved, contrasting with large scale operations in that development of more than 100 hectares represent 3.7% of the total number of coffee growers and produce around 54% of the coffee while farms of 20 hectares or less represent almost 83% of the total number of farms and produce close to 14% of the coffee grown in the country.

Livestock

The development of livestock is insufficient for satisfying the nutritive needs of a population whose growth is subject to huge nutritional deficits and which lack protein foods, like meat and milk, which are irreplaceable in a balanced diet. Stockbreeding is extensive, yet areas dedicated to pastures and other valuable products are under-utilized. This situation is further complicated by the small size of the country, a shortage of natural resources and human necessity.

II. RESEARCH ACTIVITIES

1. General Development Policy for the Agricultural Sector

Agricultural production is the activity which contributes most to the country's gross national product. Furthermore, it constitutes one of the main sources of foreign exchange; is a determinig factor in employment and income for a majority of the population, and contributes to public financing and the national economy. However, the production of basic foods is not sufficient to satisfy the growing consumption needs of the population. The government has established as a fundamental principle of development for this sector, that of providing for the welfare of the country's population. In order to do so, it has defined objectives which must be attained during the 1978-1982 period as being:

- To raise income generated by this sector through greater productivity and to improve distribution of the same.
- To expand employment capacity in the agricultural sector.
- To achieve greater force in agricultural exports for traditional products as well as for non-traditional items.
- To further the substitution of imports, mainly of basic foods.
- To advance the social mobility of different groups found in the rural environment and to contribute to the solution of existing problems.
- To maintain and develop renewable resources.
- To favor uniform development of the different regions of the country.
- To support the process of Central American integration.

The preceding objectives are in agreement with those indicated for the economy as a whole. In this manner, the agricultural sector plays a dynamic role which will, in the near future, permit the country to overcome many of the problems which have restrained its development.

2. Regionalization

The agricultural development program gives consideration to the distribution of land used for agriculture, taking into account four regions defined by the Ministry of Agriculture and Livestock:

- Region I, including the Departments of Santa Ana, Aluachapan and Sonsonate.

- Region II, composed of Cabañas, San Vicente and La Paz.

- Region III, which takes in the Departments of Usulutan, San Miguel, Morazan and La Union.

3. Importance of Research in the Development of the Agricultural Sector

In order to ensure that the objectives outlined in the development plan are met, it is indispensable that serious and prolonged research is developed in order to:

- Assist in orienting financial and human resources towards priority disciplines, according to the needs of the country.

- Serve as a basis for improving agricultural productivity, developing innovations and verifying their adaptation to conditions particular to each region.

Agricultural research is a prime factor in encouraging progress in the country. The importance of research is due to a need to discover new materials and to adapt suitable methods to different regions and economic conditions; and form the pressing need to put certain measures into practice which favor greater production efficiency and a better use of natural resources.

4. National Policy for Agricultural Research

The government has sole responsbility for research done in the Salvadoran agricultural sector. This is carried out under the following national research policy:

4.1 Objectives

To develop applied research in all subsectors which is best suited to the ecological conditions of the country, taking into account

the restoration and rational use of renewable natural resources and physical inputs, as well as economic output and greater use of manpower.

4.2 Instruments

Agricultural research is carried out by means of the following instruments:

4.2.1 Research programs being implemented, among which the most important are:

- Basic Grains (corn, grain legumes, rice and sorghum)
- Agroindustrial crops
- Vegetable crops
- Mixed crops
- Animal science
- Research in the technology of animal husbandry
- Agrostology (pastures and forage)
- Veterinary research

4.2.2 Regional research centers

4.2.3 Other programs:

- Professional education of researchers
- International collaboration
- International agreements.

4.3 Scope

At the national level, considering the needs of the different regions of the country.

5. Organization Chart and Characteristics of the Agricultural Public Sector and Other Institutions Dedicated to Agricultural Research (see Charts No. 1 and No. 2)

6. Institutions Doing Research in the Agricultural Sector

As previously mentioned, official entities are developing research in the agricultural sector, through the following institutions: (see Chart No. 1). The National Center for Agricultural Technology - CENTA; the General Office of Livestock; the Center for Agricultural Development - CEDA-Izalco; the General Office of Renewable Natural Resources; the Coffee Research Institute of El Salvador - ISIC; the School of Agricultural Sciences of the University of El Salvador; and the Nutritional Institute of Central America and Panama - INCAP - an international organization which plays an important role in developing and providng technical assistance to national and regional research carried out in the Central American countries. The characteristics, functions and projects developed by each of the institutions mentioned are outlined as follows: (see Chart No. 2).

6.1 National Center for Agricultural Technology - CENTA

This is an organization of centralized operations which is politically, financially and administratively dependent to the Ministry of Agriculture and Livestock.

6.1.1 Functions:

To orient agricultural research towards securing varieties with high yields and nutritional content which, in addition, are resistant to plagues and diseases.

To strengthen the system for biological control of cotton plagues.

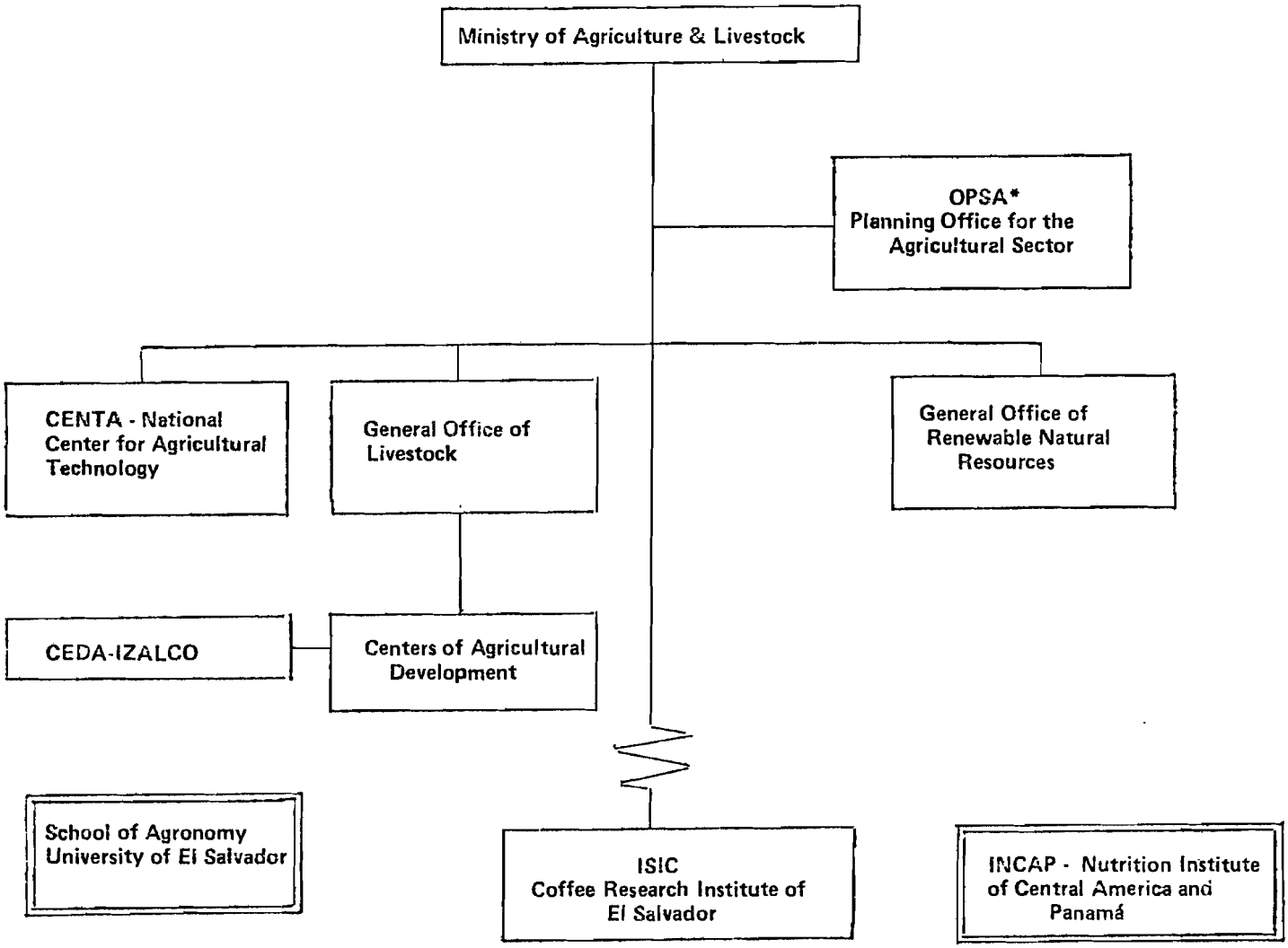
To expand research aimed at obtaining varieties with industrial potential and those which present possibilities for sale on the international market.

To create specific programs oriented towards the comprehensive use of agricultural by-products.

Chart No. 1

ORGANIZATION CHART

Institutions dedicated to Agricultural Research



* Planning Office for the Agricultural Sector - OPSA

This is an advisory unit of the Office of the Minister, hierarchically dependent to the branch heads for administrative and operational purposes. Together with the Ministry of Planning for Economic and Social Development, this office has the task of formulating the development plan for this sector; preparing programs according to products; and designing operational plans as well as achieving a bilateral and constant flow of information, background material and consultations so as to insure success in preparing and executing respective plans.

TICS OF THE RESEARCH INSTITUTIONS IN THE AGRICULTURAL SECTOR

EL SALVADOR

	Type of Institution	Financial Resources		Research Field	Type of Research 3/	Total no. proffes-sionals with institutions	Personnel dedica-ted to research				% research staff against total person-nel.
		Self generated	Gov.				P	M	Prof.	Tech.	
culture MAG	National Public	3	97	Agric. 2/ Livestock	Applied	205 4/	6	4	80	121	44
	National Public	-	100	Livestock	Applied			1	7	3	
of	National Public	-	100	Livestock	Applied	6 5/		2	4	4	100
	National Public	2	98	Coffee	Applied	116		1	36	79	32
	National Public	-	100	Natural Resources	Applied	92		4	14	22	20
cation	National Public	94 1/	4 1/	Agriculture Livestock	Applied	70	1	14	42	26	81
rganiza-	Internatio-nal Public			Nutrition -human -animal	Basic Applied						

international organizations

cultural research as compared to livestock.

rch to be fundamentally applicable though laboratory testing is required to compliment their studies.

and five consultants to the CENTA-AID Project.

embers and one professional advisor from INCAP.

6.1.2 Organizational Structure

Research activities are carried out by the Agricultural Research Division which is directly tied to the executive office from which it receives technical and administrative guidelines.

Agricultural Research Division

The Agricultural Research Division (Chart No. 3) has two support units. One is a foreign advisory unit consisting of a group of consultants from the University of Florida, sponsored by the Inter-American Development Bank and the Technical Assistance Agency of the British Government. The advisors in this group are assigned to the different departments of the division. The other support unit includes international research centers such as: a) The International Center for the Improvement of Corn and Wheat, CYMMYT, which furnishes technical assistance and genetic material for corn and sorghum crops, and provides training courses in the production and improvement of these crops; b) The International Center of Tropical Agriculture, CIAT, which lends technical assistance and genetic material for rice, bean and cassava crops, and offers training courses in the field of animal science; and c) The Center for Research and Training in Tropical Agriculture, CATIE, which gives technical assistance on mixed crops.

The departments of phytotechnology, plant parasitology, soil, chemistry, animal science, agricultural economics and biometrics serve as operational units for this division.

6.1.3 Description of Research Programs

CENTA is developing the following programs:

6.1.3.1 Program: Basic Grains (corn, grain legumes, rice and sorghum).

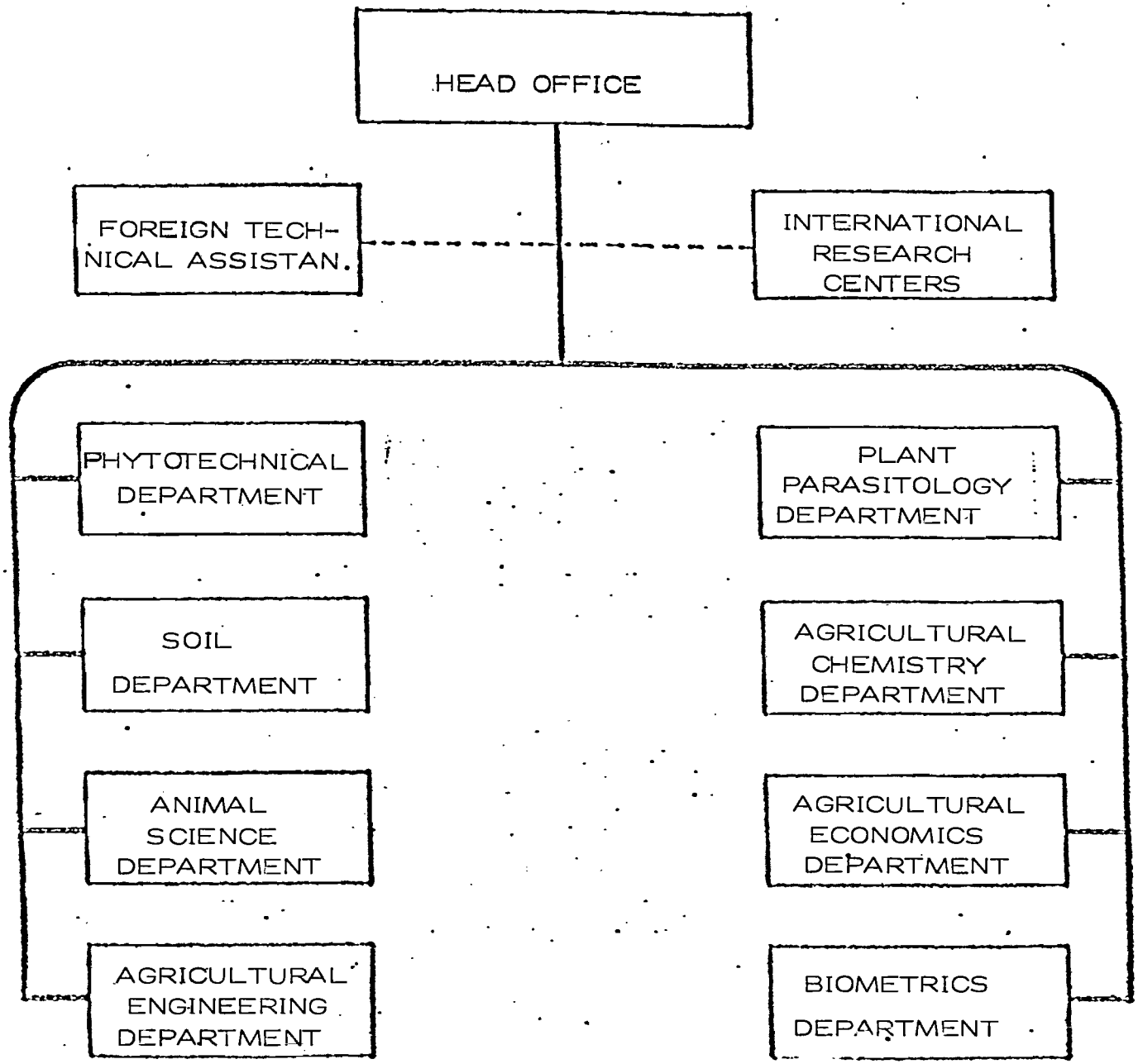
Nutrition for the Salvadoran population rests primarily on the consumption of basic grains, corn being the main source of nourishment.

Chart No. 3

ORGANIZATION CHART OF THE AGRICULTURAL RESEARCH DIVISION

1977

CENTA



Objectives:

- To evaluate the features of different basic grain crops in order to select varieties acceptable because of favorable characteristics and high yields.

- To research and experiment with new production techniques which, through the effective transfer of technology, will increase productivity of basic grains making better use of resources available to the farmer.

6.1.3.2 Program: Agroindustrial crops such as oil seeds (soybeans, sesame seed, peanuts), sugar cane, fibers (cotton, henequen), etc.

Objectives:

- To study and evaluate agroindustrial species with the aim of selecting those demonstrating agriculturally desirable features adaptable to environmental conditions and having high economic potential.

- To analyze and research different factors influencing the development of agroindustrial crops for the purpose of finding effective technology for improving productivity.

- To research, by means of field tests, major problems confronting these crops.

- Tõ furnish the cane growers of the Jiboa Valley and neighboring areas with technical assistance necessary for increasing productivity.

6.1.3.3 Program: Vegetable Crops

Objectives:

- Development of intensive production technology which shall contribute to an increase in production efficiency and the level of profits for vegetable crops.

- Selection and introduction of potentially high yield vegetable varieties which fit the climatic conditions of the country.

- Study and testing of methods aimed at reducing production costs.

6.1.3.4 Program: Fruit Growing

Objectives:

- To evaluate the performance of different fruit trees with respect to factors such as state of fertility, planting seasons, climatic and soil conditions in order to select the more suitable varieties and those which promise most in terms of quality and yield.

- To evaluate the production potential and agricultural features of different varieties of fruit trees.

- To investigate new techniques for improving methods used in fruit production

6.1.3.5 Program: Mixed Crops

Objectives:

- To study the agricultural performance of traditional crops for the purpose of establishing the best production combinations.

- To investigate technological practices which permit intensive land use and the continual employment of the rural labor force.

- To analyze, from a socioeconomic point of view, production of combined crops in order to determine those of greater profitability.

6.1.3.6 Program: Animal Science

Objectives:

- To study and analyze major problems affecting livestock yields for different species in order to find the most effective and economic solutions.

- To evaluate the performance of different livestock species for the purpose of designing adequate feeding systems to increase farm production and profitability.

- To generate technology for the preservation of pastures and forage, as well as for the use of animal by-products.

6.1.3.7 Program: Special Projects and Laboratory Services

Objectives:

- To investigate and analyze agrochemical products and their repercussions on the environment with the object of establishing recommendations concerning their rational use.

- To provide, through the use of different laboratory services, technical assistance in a variety of specialized fields such as: soil fertility, plant parasitology, agricultural chemistry and biometrics.

- To detect the country's immediate and short term irrigation needs and the ratio between water loss calculated by lisimeter and that determined on the basis of agrometeorological information; as well as to detect the raw materials used in the country for agricultural and simple construction.

6.1.4 Priority Fields of Research

The National Center for Agricultural Technology defines the country's priority areas for research as being:

6.1.4.1 Food Crops (corn, grain legumes, rice, sorghum).

- Genetic improvement
- Management of growing practices

6.1.4.2 Vegetable Crops

- Potatoes, tomato, cassava, cabbage, sweet pepper, carrots, and sweet potatoes.

6.2 General Office of Livestock

This is an organization with centralized operations which is politically, financially and administratively dependent to the Ministry of Agriculture and Livestock. Its research division, responsible for veterinary investigations and those done on the technology of animal husbandry, maintains direct contact with the divisions of livestock technology and animal health; the regional directors, and those of CEDAS 1/ in order to determine orientation and content which must be given to research programs aimed at finding alternatives benefitting the development of activities particular to the livestock subsector. These, in turn, shall contribute to improving nutritional, sanitary and genetic conditions and to the management of the country's livestock species.

6.2.1 Functions:

- To prepare studies for livestock zoning based on ecological conditions and the farmers' ideas on stockbreeding.
- To give greater emphasis to the economic use of by-products derived from basic grain crops in the balanced feeding of livestock.
- To re-orient experimentation with forage species in view of nutritional quality, palatability, rapid growth, resistance to drought, slopes and adaptation to clay soils.

1/ Agricultural Development Centers.

- To experiment with pasture rotation in terms of pasture characteristics and gradient of the land for the purpose of preventing soil erosion.

- To re-establish, according to the country's ecological conditions, herds of native cattle as a basis for improving production.

- To carry out research on the propagation and incidence of plagues and diseases of major impact on various species of local livestock.

6.2.2 Organizational Structure

The Research Division is made up of a central office which oversees the Department of Technical Research in Animal Husbandry and the Veterinary Research Department. These, in turn, receive assistance from the Biometric Unit in the development of their projects.

The Department of Technical Research in Animal Husbandry has several units which are designated according to the work they do such as: nutrition, genetics and agrostology. The Veterinary Research Department has units for zoonotic, parasitic and specific diseases.

Research is developed with the aid of human, material, and financial resources from the three centers for agricultural development; CEDA-Izalco, CEDA-Morazan, CEDA-Chalatenango; and from the different centers for research in the technology of animal husbandry.

6.2.3 Description of Research Programs

At present, the Research Division of the General Office of Livestock is moving ahead with the following programs:

6.2.3.1 Program: Research in the Technology of Animal Husbandry.

Objectives:

- To obtain optimum response to theoretical-practical inquiries affecting stockbreeding productivity.

- To test, through a variety of production activities carried out by research centers, new methods and/or production systems which may favorably influence production and costs in order that these may be introduced and/or communicated to the user in a reliable manner.

- To introduce the use of crop residues and industrial by-products in the feeding of cattle.

- To provide the different livestock technical assistance programs with the fundamentals for more efficient technical aid.

- To discover alternatives encouraging improvement of health and nutrition in the population.

Functions:

- To carry out direct research on the suitability of animal breeds and nutritive animal species for the purpose of improving herds and animal nutrition.

- To develop research aimed at improving local livestock in aspects concerning the production and profitability of meat and milk.

- To carry out research aimed at improving the raising of swine in aspects concerning production and meat.

- To perform tests intended to improve nutrition and reproduction in cattle, swine, poultry and minor species.

- To develop research based on needs and priorities detected in the national livestock subsector in order to promote its expansion.

- To prepare periodic progress reports on testing done on technology of animal husbandry to be sent to the division chief.

6.2.3.2 Program: Veterinary Research

To develop research projects on the prevalence of the most important diseases such as brucellosis, tuberculosis, anaplasmosis, leptospirosis, the distribution of different species of ticks, etc. which will serve as a basis for developing campaigns as well as in evaluating control programs during their implementation.

Objectives:

- To assess the epidemiological behavior of diseases in the country, particularly those which have repercussions on the national livestock economy, as well as those of zoonotic importance.

- To direct programs dealing with prevention, control and/or eradication of diseases based on results obtained.

- To determine economic losses caused by diseases and their impact on both the national economy and human nutrition.

6.2.4 Priority Fields of Research

The General Office of Livestock maintains that the country needs research, particularly in the fields of animal nutrition and agrostology (pastures and forage). Therefore, this office, with the collaboration of CEDA-Izalco, has begun studies in the fields of:

Nutrition: In research with cattle there is an orientation towards the use of agroindustrial by-products like coffee pulp, sugar cane husks, corn stubble, beans, sugar cane and sorghum, all supplemented with varying doses of urea.

Research with swine is directed towards the use of agro-industrial by-products such as cottonseed, flour and whey. Moreover, the possibility of substituting tubers like yams, sweet potatoes, malanga, cassava and yautia for cereals used in porcine diets is being studied along with the possibility of using cassava, malanga, ramie and sweet potato leaves as a protein supplement.

Management: Work is being done in this area with dual purpose herds, early weaning (at two months); and double milking. Testing is developed selectively according to a cow's milk production.

If beef herds testing is being done on supplementing the feeding of calves through the use of selective feeders; and on weaning beef cattle (Zebu) at different ages in order to determine the influence this has on future deveopment in both cows and bulls.

Experiments have been carried out with milk herds on feeding fermented colostrum to calves and on the management of semi-stabled and pasture kept cows.

Genetics: Work in this area has been focused primarily on swine herds, developing an evaluation of specialized breeds, to select those which offer optimum characteristics in order that they might be developed in the country.

At present, four strains of native swine are being evaluated due to their high degree of adaptability to the environment. This is being done in order to later determine which breeds, strains or crossbreeds are suitable for recommending to the country.

Some data on strains or crossbreeds of beef cattle has been obtained; however, this information is not highly reliable.

Three projects have been proposed which contemplate reinstating native cattle and evaluating crossbreeding between Zebu-Holstein and Zebu-Brown Swiss using Zebu cows for impregnation.

These tests are, basically, aimed at developing a cross-breed capable of development for both meat and milk.

Agrostology: In this area, great importance has been given to evaluating major types of graminous forage (native varieties and those introduced into the country) management, fertilization, and control of disease and plagues. Native leguminous forage is being selected and that which demonstrates the most favorable production and adaptation characteristics is being introduced.

Combinations of graminous and leguminous forage are being evaluated on the basis of their suitability and resistance to grazing.

The most practical and the best methods for storing grass - silos and hylofts - are being studied along with the different cutting seasons, fertilization and planting density for CENTA-2 Sorghum.

Tests have been done on yields, fertilization and planting density for tubers, sweet potatoes, malanga, yautia, ñame or yams and cassava.

The soil-plant-animal trilogy is being examined in all of the studies on pastures and forage.

6.3 Center for Agricultural Development - CEDA-Izalco

Like the other two CEDA centers in the country (CEDA-Chalatenango and CEDA-Morazan), CEDA-Izalco is dependent upon the General Office of Livestock and has as its prime objective that of finding an appropriate answer to the problems facing livestock production in the zone in which it is located, thus increasing productivity of livestock operations and the socio-economic level of producers. In this respect, these centers

focus their programs on training and research activities.

6.3.1 Functions:

- To investigate problems confronting livestock production with regard to veterinary aspects and those dealing with the technology of animal husbandry in an attempt to find real answers atune to conditions existing in each region of the country.

- To impart objective training to researchers involved in various activities within the livestock sector.

6.3.2 Organizational Structure (Chart No. 4)

The development of research activities is the responsibility of the section chief who must possess extensive experience in this field for the purpose of coordinating activities of the Cattle, Swine, Minor Species, Soil and Forage, and Health Units.

Unit Functions

Cattle: Work is done with milk, dual purpose and beef herds. Each herd has a head man and his assistants who tend the cattle and are familiar with the tests being done.

Swine: Work is carried out with improved strains and native swine, particularly in the area of nutrition.

Minor species: This unit controls testing done on poultry, rabbits and bees.

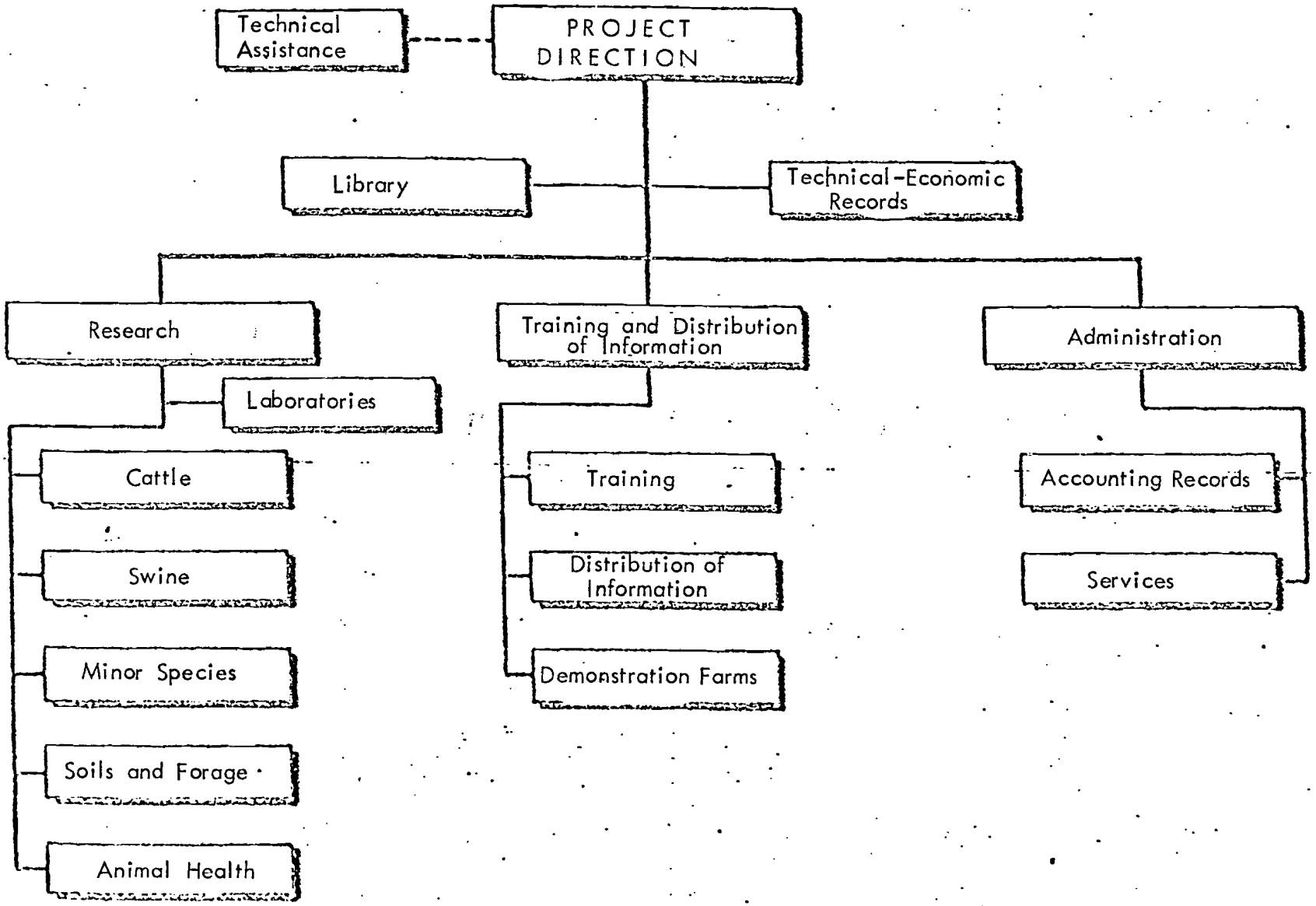
Soil and Forage: This unit covers the areas pertaining to gramineas, legumes and tubers. Testing directed towards improvements in animal feeding is being developed in each of these areas.

Animal Health: Investigations proposed by the Veterinary Department of the Research Division, are developed by this unit.

CHART No. 4

ORGANIZATION CHART OF THE LIVESTOCK DEVELOPMENT CENTERS

CEDAS



Laboratory: This unit is considered as being absolutely essential in carrying out bromatological analysis, diagnosis and other services required by the center.

6.3.3 Description of Research Programs

The following research programs are currently being carried out:

6.3.3.1 Program: Cattle

Milk Herd:

- Use of a mixture of NNP-molassas in the breeding and fattening of young bulls.
- Economic results with calves raised by grazing.

Dual Purpose Herd:

- Effect of two protein levels in production performance.
- Response: Early weaning of cows in milk production.
- Fattening of corralled cattle on the basis of forage and a mixture of urea and molassas.
- Profitability of feeding animals growing, and those being fattened, during the dry season with rations based on sugar cane husks.
- Use of whole sugar cane as feed calves during the dry season.

Zebu Herd:

- Effect of raising young Zebu steers in pastures and corrals.
- Effect that supplements, applied through the use of selective feeders, have on calf growth.

- Comparison of the nutritional value of sorghum and hay silage mixed with a source of non-protein nitrogen in raising steers and young Zebu bulls.

6.3.3.2 Program: Swine

- Preliminary study on the raising of native swine (classification of native swine according to similar characteristics).

- Use of fresh tubers with different levels of protein supplement in fattening swine.

- Supplement of cottonseed flour and fish meal as a principle source of protein in fattening swine.

- Apparent digestability of nutrients found in malanga tubers.

- Preliminary study on the use of sweet potatoes in feeding swine (palatability and maximum consumption).

- Rational use of whey in fattening swine.

- Comparison of bioeconomic results of controlled feeding and ADLIBITUN in fattening swine.

- Grazing swine in malanga cultivations.

- Fattening swine in pastures.

- Effect of green supplements in balanced rations for fattening swine.

- Dietary supplements of fresh malanga leaves.

- Comparison of biological effects found in sows having access to dirt corrals and those subjects to complete confinement.

6.3.3.3 Program: Minor Species

Poultry

Test Name:

- Effect of varying levels of molassas on the unbalanced feeding of laying hens.

- Evaluation of three feeding systems in the traditional breeding of Kaky Campbell ducks.

- Effect of a special molassas (Colocasia sp.) in the feeding of chickens which are being fattened.

Rabbits

Test Name:

- Use of different amounts of Vigna sinensis (beans) and ramie (Bohemeria nivea) in feeding rabbits.

Bees

Test Name:

- Influence of artificial feeding during different periods of handling on the production of honey.

6.3.3.4 Program: Forage

Test Name:

- Versatility of different legumes planted alone or together with graminae.

- Study on adaptability and fertilization levels in different varieties of grass.

- Potential of grass siloed with poultry excrement for use as cattle feed.

- Study on the siloing of sugar cane husks and poultry excrement.

- Study on the siloing of malanga and sweet potatoes (tubers and foliage)

- Types and fertilization levels in malanga.

- Agricultural studies on yautia crops.

- Agricultural experiments with the Vigna bean.

6.3.4 Priority Fields of Research

CEDA-Izalco maintains that the country must intensify and develop livestock research in the areas of nutrition, management, genetics and agrostology as applied to: (See article on this topic in the section dedicated to the General Office of Livestock).

Cattle:

- Dual purpose herds: Work is being done with native cattle and with 80% of the small and medium sized stockbreeders.

- Milk herd.

- Beef Herd.

Swine:

- Native swine: Work is being done with 85% of the small and medium sized stockbreeders.

- Improved swine: Work is being carried out with large scale stockbreeders.

6.4 General Office of Renewable Natural Resources

This is an organization with centralized operations which depend, politically, financially and administratively on the Ministry of Agriculture and Livestock. Its purpose is to achieve optimum utilization of renewable natural resources.

6.4.1. Functions

- To establish special programs of applied research which shall determine the adaptation of forestry species most suited to ecological conditions; the rational management of forests; and the use of forestry products in terms of their domestic demand.

- To calculate water variables at the river basin level in order to achieve a balance between renewable natural resources and their comprehensive use.

- To emphasize research on plagues and diseases for the purpose of determining the best methods of their prevention and control in forestry species.

- To establish research programs on the use of forestry by-products.

6.4.2 Description of Research Projects

6.4.2.1 Project: Reforestation, Soil Conservation and Flood Control in the La Palma River Region.

The type of research to be developed will be aimed at protecting and restoring a critical area located in the lower basin of the La Palma River, as well as other areas in a similar condition and whose sediment has an effect on reservoirs, the "5 de Noviembre" and "Cerron Grande" dams and possibly the new hydroelectric station currently under construction.

This project will attempt to restore depleted land in areas of permanent agricultural use and to generate sources of employment in order to substantially improve living conditions for the population of the country's northern zone.

Objectives:

- To develop and evaluate plans for the management of hydrological sub-basins with flood problems, placing emphasis on the northern zone of the country.

- To prepare and evaluate reforestation, soil conservation and flood control projects for protecting critical areas along the La Palma and Azambio Rivers.

- To encourage inter-institutional activities between this institution, other public organizations and the business sector in order to make rational use of soil and water resources.

- To furnish information necessary to policy decision-making circles in order to direct developmental guidelines affecting priority basins.

- To avoid draining away the useful life of the hydroelectric dams in the northern zone of the country.

- To encourage the establishment of agro-industry for agricultural and forestry products.

Geographic Location: Northern zone.

6.4.2.2 Project: Agrometeorology and Energy Utilization.

This project will contemplate the scientific investigation of meteorological variables affecting the production of food and raw materials in terms of quantity and quality, as well as the micro-climatic conditions which favor the growth of plagues and diseases.

Objectives:

- To apply the results of research on the effect climate and time have on crops to the practical aspects of agricultural production such as:

  - An agroclimatic classification of the country into zones of optimum yield.

- Harvest forecast.

- Forecasting the development of plagues and diseases.

Geographic Location: The four regions of the country.

6.4.2.3 Project: Master Plan for Water Resources

An attempt will be made to formulate a master plan for water resources. In order to do so it will be necessary to evaluate surface and subterranean water available in the country at the basin level for the purpose of determing its potential as well as current and future hydraulic needs of the different sectors and in order to prepare individualized programs necessary for the multiple use of water resources. At the same time, elements of a jurisdictional and legal nature will be established for the management of the same, and proposals will be made for related activities aimed at making adequate treatment feasible. The plan will conclude with a program for administrating these resources.

Objectives:

- To evaluate the potential of the country's surface and subterranean waters in order to prepare plans for management and utilization of water resources.

- To formulate a master plan for water resources designed to achieve their adequate and rational management.

- To protect both the quantity and quality of the country's water resources.

Geographic Location: The entire country.

6.4.2.4 Project: System of National Parks and Similar Resources.

To identify, select, establish, administrate and develop national parks and similar reserves for conservation, study, tourism and recreation. To establish a basis for the preservation and management of flora and fauna and to identify factors having a negative effect on the same.

Objectives:

- To preserve and protect ecological systems or natural areas representative of the country's natural heritage by establishing national parks and/or similar reserves for determining their potential use and optimum development.

- To preserve, protect and develop the country's wildlife through management programs and the establishment of laws and regulations to protect and develop wildlife throughout the entire country, particularly in national parks and reserves.

Geographic Location: Ahuachapan and Santa Ana.

6.4.2.5 Project: Construction of Aquicultural Development and Experimental Centers.

Aquiculture is an area of the fishery subsector which is of considerable importance to the country's agricultural development as it can contribute to an increase in income for private and public agricultural enterprise; to the industrial development of the country; and to the generation of work for the Salvadoran labor force.

Objectives:

- To familiarize private enterprise with the effect this method of plant cultivation can have on agricultural profitability.

- To increase fish production in order to make this item more accessable to the population.

- To improve the diet of the population of El Salvador.

Geographic Location: Region IV (San Miguel, Morazan, La Union y Usulutan).

6.4.2.6 Project: Determing Potential Soil Use

This project is aimed at acquiring knowledge on soils found within the country. For this purpose soils will be classified according to composition and performance in order to later determine their productive capacity. This will be done by means of a systematic study of soils, in the field and in the laboratory, with the objective of presenting this data on two types of maps: one of soils and the other of their potential productive capacity. These will be of use in truly distinguishing the country's agricultural potential, as well as in improving the programming of agricultural development and the establishment of production alternatives.

Objectives:

- Establishment of agricultural production alternatives by determining productivity of land within the country.

- Taxonomical soil classification according to physiochemical and biological characteristics.

- Determination of land capacity for classification purposes.

- Objective analysis of potential land use by means of studies on its economic interpretation.

Geographic Location: All regions of the country.

6.4.2.7 Project: Expansion and Improvement of Hydrological Service.

In the different hydrographic basins, research will be oriented towards securing, computing and checking capacity of rivers and diversion canals and the reading of limnigraphic maps; to obtaining water samples for physiochemical analysis; to determining quality in view of twenty-five different variables; acquiring water samples; and assessing sediments in order to evaluate soil loss.

Objectives:

- To strengthen phydrological service in order that this may affect research and studies contributing to the rational and multiple use of water resources. And, at the same time, to formulate, by means of a model, hydrological forecasts to be used in the design of water works.

- To convert these studies and investigations into a source of hydrological information available to different sectors working towards the solution of administrative problems concerning water resources.

Geographic Location: The entire country.

6.4.2.8 Project: Agricultural Zoning - Phase III

This project will consist of the selection of areas, and the design and evaluation of comprehensive rural development projects for priority areas of the country, making use of information obtained in Phase II.

Objectives:

- To contribute towards obtaining production, productivity and employment objectives in the agricultural sector, and to improving socio-economic conditions in the rural environment through the design, evaluation and development of comprehensive rural development projects in priority areas of the country.

- To develop programs for the training of human resources compatible with the objectives of comprehensive rural development and with the requirements of specific projects in order to insure the systematic participation of local human resources and the collaboration of other institutions.

Geographic Location: The Paracentral and Eastern Region (actual work areas have not yet been defined).

6.4.2.9 Project: Inventory and Renewable Natural Resources Bank

This program will serve to satisfy the demand for information on the natural and socio-economic variables required in the country's regional planning operations. It will also provide for a system of data-feedback on these resources by establishing a technical file of research and analysis done on soil, forestry, fishery and climatic resources and their respective transfer in order that they be put to multiple use.

Objectives:

- To systemize computarized processing, analysis, evaluation, classification and distribution of technical, scientific information on renewable natural resources which will facilitate the development of comprehensive studies.

- Design of a system of forestry statistics.

- Expansion and up-dating of the system used in the Fishery Resources Data Bank.

Geographic Location: The entire country.

6.4.3 Priority Fields of Research

The General Office of Renewable Natural Resources maintains that there is a need in the country to intensify research on the following aspects:

- To research different crops which permit the conservation of water and soil resources.

- To develop economic and social studies determining the factors preventing the country's economic and social development.

6.5 Institute of Coffee Research of El Salvador

This is an organization with operational autonomy, dependent to the Ministry of Agriculture and Livestock.

6.5.1 Functions:

- To develop research programs aimed at solving problems inherent in the cultivation of coffee.

- To transmit results obtained through different means of communication, particularly through the technical assistance and district distribution services.

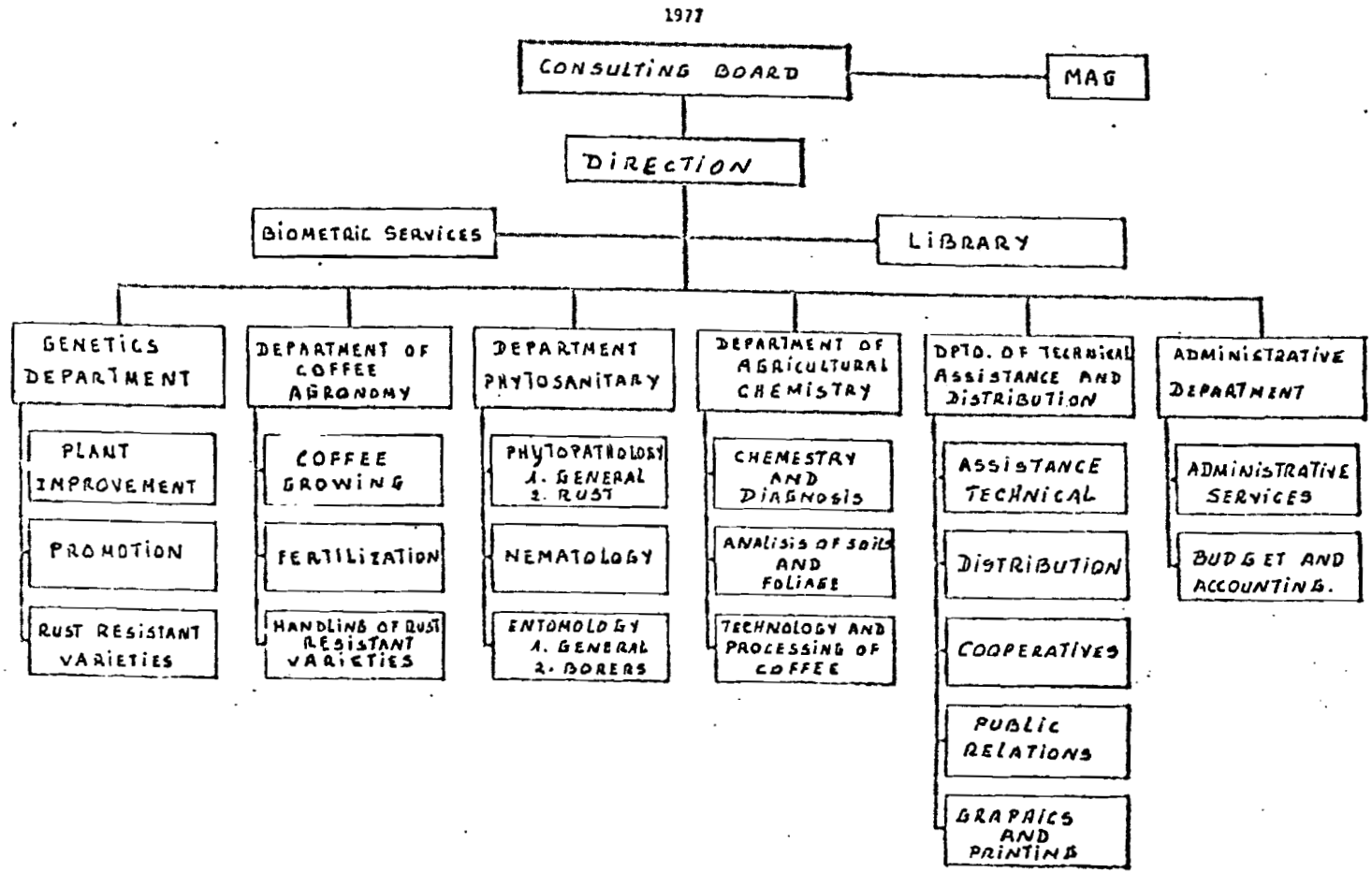
6.5.2 Structure of the Organization Chart (See Chart No. 5)

6.5.3 Priority Fields of Research

Due to the appearance of rust affecting coffee plants in the neighboring Republic of Nicaragua, a fact which constitutes a potential threat to El Salvador, ISIC has doubled its efforts in order to prepare the country. These endeavours are concentrated in the

Chart No. 5

Organization Structure Chart of the Coffee Research Institute of El Salvador



field of education, instructing the coffee growers in identifying and controlling rust on their plantations.

For several years, ISIC has been studying rust resistant varieties of coffee and methods for controlling this disease and borers.

6.6 School of Agricultural Sciences, University of El Salvador

This is an autonomous organization belonging to the Ministry of Education. Its functions are oriented towards the areas of education and research.

6.6.1 Description of Research Projects

The following are research works currently being carried out by the School of Agricultural Sciences:

Designated by: a) Project title

b) Project objectives

c) Areas of the country covered by the project

6.6.1.1 a) Agricultural evaluation of 14 varieties of soybeans at the "La Providencia" agricultural experimental station.

b) To obtain information on the performance of soybeans in the country and, if possible, on alternative crops given the demand for this product on the international market.

c) Central zone.

6.6.1.2 a) The effect of three planting seasons on two varieties of sesame seed (Sesamum Indicum).

b) To evaluate yield and the best planting seasons for sesame seed, and in addition, to gather other experimental data related to this crop.

c) Central zone.

6.6.1.3 a) Bioecological study of the boll weevil (Anthonomus grandis).

a) Bioecological study of the Trichoplusia ni (worm).

a) Bioecological study of the Alabama orgillaceae (worm).

b) To study bioecological cycles of the pests in question for the purpose of ascertaining the best way to combat them.

c) Costal zone.

6.6.1.4 a) Study of viral diseases in cotton.

b) This is a project consisting of several subprojects whose common objective is to determine the correlation between certain vectorial insects, weeds and viruses in cotton.

c) The entire country.

6.6.1.5 a) Evaluation of insecticides for handling plagues affecting cotton.

b) To determine dosis application periods and the best products for controlling and handling populations of insects which attack cotton.

c) Costal zone.

6.6.1.6 a) Effect of 2-Cloroctil Phosponic Acid in the ripening of coffee (Cofea arabiga)

b) To evaluate different doses of this acid with the object of obtaining uniform ripeness in coffee, thus avoiding waste and an increase in the labor costs.

c) Coffee growing zones.

6.6.1.7 a) The effect of different spacing in the cultivation of sesamae seed (Sesamum indicum).

b) To evaluate yield per growing season and the best spacing in planting seeds.

c) Central zone.

6.6.1.8 a) Evaluation of native bean germplasm (Phaseolus vulgaris) and securing of strains with greater possibility for adaptation.

b) To find, by means of crossbreeding and selection, strains and varieties with greater adaptability to climate and soil conditions, going beyond the limits of varieties actually in use.

c) The entire country.

6.6.1.9 a) Testing of varieties and improving the Psophocorpus tetragonolobus (bean).

b) Improvement of the Psophocorpus tetragonolobus seed and obtaining of preliminary information on its agricultural performance under conditions, in El Salvador.

c) Central zone.

6.6.1.10 a) Testing mixtures of pre-emergent herbicides used in corn (Zea mays).

b) To evaluate adequate doses of pre-emergent herbicides for wide and narrow leaf varieties and to draw conclusions as to their profitability.

c) The entire country.

6.6.1.11 a) History, use, form and composition of organic fertilizers.

b) To search for possible ways of partially substituting chemical fertilizers through the use of organic fertilizers.

c) The entire country.

6.6.1.12 a) The study of phosphoric fertilization in grain legumes.

b) To evaluate the fixative capacity of phosphate in the soil and its eventual availability in soils where grain legumes are cultivated.

c) The entire country.

6.6.1.13 a) Study of the symbiotic relationship between Vigna Sinensis and Rhizobium sp.

b) To look for native Rhizobium vines which best form nodes in these legumes.

c) Central zone.

6.6.1.14 a) Calculation of losses caused in El Salvador by cotton ball decay.

b) To compare and determine decline in quality and quantity of cotton with percentages for cotton ball decay, and to estimate economic losses.

c) The entire country.

6.6.1.15 a) Evaluation of different combinations of gramineae and legumes (inter-institutional project: School of Agricultural Sciences - Ministry of Agriculture).

b) To evaluate nutritional aspects and the agricultural compatibility of the crops under study.

c) The entire country.

6.6.1.16 a) Studies on the natural fertilization of soils in the cultivation of peanuts (Arachishipogea) (Inter-instituinal project: CENTA-School of Agricultural Sciences).

b) To quantify crop response to different sources of Ca++ and to estimate critical levels of the different elements in this plant.

c) The entire country.

6.6.1.17 a) Research Project on Minerals in Cattle. (Joint Project: General Office of Livestock, University of Florida-CENTA, the School of Agricultural Sciences).

b) Through biopsies and blood tests done in the country's municipal slaughterhouses, an attempt will be made to analyze the deficit in cattle nutrition. Furthermore, brematalogical analyses are being done in cattle raising zones.

c) The entire country.

6.6.1.18 a) Thick control in cattle.

b) This project consists of various sub-projects whose objective is to evaluate different methods for controlling ticks and their economic advantages.

c) The entire country.

6.6.1.19 a) Cassava (Manihot esculenta) in feeding of Ruminants.

b) This project includes various sub-projects on using cassava mixed with other nutritional supplements such as cane, for example, and its use with beef cattle.

c) The entire country.

There are many other projects begun recently in the area of animal husbandry, as for example, those on:

- The bioeconomic behavior of grazing milk cows subject to different levels of concentrated supplements during lactation.

- Evaluation of two breeding systems and of methods for feeding suckling calves.

- The effect of supplements of oxidizable, heat producing and photosensitive vitamins on commercial concentrates.

6.6.2 Priority Fields of Research

The School of Agricultural Sciences considers the development of research to be of immediate importance:

- In agriculture, directed towards the immediate and short term production of more and of better food including the introduction of new varieties, improvement on already existing varieties and the replacing of traditional agricultural practices; prevention and control of plagues; the storage of grains; etc.

- In stockbreeding, directed towards the improved and efficient feeding of beef and milk cattle, swine, goats, etc., looking for sources of nourishment in the country's vegetable products.

  Another important aspect is the management of grazing or stabled herds, disease control and the ratio of native cattle and crossbreeds of the same to pure breed cattle in order to provide for adequate production in accordance with ecological conditions in the country.

6.7 Nutrition Institute of Central America and Panama - INCAP

INCAP is a technical organization of the six countries of the Central American Isthmus. By decision of member governments, INCAP operates under the administrative supervision of the Pan American Health Office, regional office of the World Health Organization for the Americas.

6.7.1 Functions

INCAP duties include the development of research, the training of personnel and technical assistance, on nutritional matters, to the governments of the six countries of the region.

6.7.2 Description of Research Programs in El Salvador (1976-1979)

The document "Assistance Program for the Development of Intensive Production Systems Processing and the Rational Utilization of Food" includes the projects and sub-projects of the technical assistance program being carried out by the INCAP Division of Agricultural and Food Sciences in the Republic of El Salvador. This program has as its general objective that of collaborating with the Ministries of Agriculture and Livestock (MAG) and Public Health in developing systems for the production, processing and the utilization of food of vegetable or animal origin, in order that these be ever more efficient and that food be increasingly available to the population.

There are two projects actually underway. The first, entitled "Intensive Production of Foods of Animal Origin", includes the following sub-projects:

- Field research in collaboration with CEDA (Center for Agricultural Development of the General Office of Livestock, (MAG)-Izaldo).

- Technical assistance and field research in collaboration with CEDA-Chalatenango and CEDA-Morazan.

- Establishment of an operational and administrative system for the Distribution Unit of the General Office of Livestock.

- Training of professional and technical personnel of the General Office of Livestock.

- Utilization of coffee pulp in feeding cattle.

The second project deals with "Utilization of Vigna sinensis in the Production of Foods of High Nutritional Value", and includes two sub-projects:

- Development of protein rich foods based on the Vigna sinensis.

- Utilization of this bean in producing processed foods.

6.7.3 Projections for INCAP Technical Assistance in El Salvador.

The following is a summary of basic concepts regarding that which is felt must be the projection for technical assistance provided in the future by INCAP to a country like El Salvador which requires a tremendous amount of technological innovation in order to be able to supply the nutritional requirements of the population.

Agricultural productivity, particularly that related to producing new crops, must be joined to a system for utilization in order to insure success. Utilization systems may be varied in nature. One of these is that direct consumption on that part of the population; another, would be the transformation of agricultural products into processed foods to be used as such or as components of other nutritional systems.

On the other hand, technical assistance provided by INCAP to El Salvador in the area of animal nutrition has as its aim the adaptation of developed technology to local needs as well as developing technology suitable to the area or more atuned to existing conditions in specific areas of El Salvador. The transfer process, does not, however fulfill its true commitment unless it is of benefit to the population.

The agricultural productivity of basic grains and other foods of vegetable origin, like results of activities carried out in the development and evaluation of foods for increasing animal productivity, must be integrated in an agro-industrial system whose objective is that of improving the socioeconomic and nutritional state of the country's rural community. The integration process is a complex one requiring the active participation of the agricultural public sector which can establish necessary infrastructure in order that individual activities of the vegetable and animal production sectors, as well as the industrialization or transformation of food, may develop. This integration is a relatively slow and complex process requiring the establishment of a model which will permit, with sufficient certainty, the success sought after in any proposed by each individual sector.

Objectives in establishment of the model would be:

a) To develop systems for the agricultural production of food for human or animal consumption, or industrial raw material; b) to develop and implement systems for conserving and transforming foods for man or animal; c) to use plant or animal products, or by-products in a mutually complementary manner; and d) to introduce, together with the above-mentioned, agricultural and home extension activities as well as measures for public health and nutrition.

The results achieved up to now by the technical assistance program may already be put to use in establishing the model. INCAP wishes to apply results obtained in order to increase livestock productivity. On the other hand, there exists sufficient information for utilizing and diversifying use of the Vigna sinensis, for example, a legume of considerable interest to the Salvadoran Ministry of Agriculture and Livestock. In the case of the latter, agroindustry using the Vigna sinensis as an ingredient in various types of processed foods may be established with financing available from the BCIE and other organizations. At the same time, other agricultural products can, through appropriate agroindustrial development, from part of a soil-plant man or animal system.

The establishment of the model, its execution and success obtained will depend upon the action taken by the Ministry of Agriculture and Livestock and on the certainty of continuity. At the same time, the success of the model, measured on the basis of improvement which may be achieved in the socio-economic and nutritional state of the population, will depend on the application of results obtained by the model support units which are the activities in food production technology and animal nutriton. Finally, INCAP, through its different programs, will be able to collaborate with personnel and financing in the implementation and evaluation of specific activities within the model, in particular, those related to the development or impact of agro-industry, as well as nutritional and health activities which may be developed.

7. Publications

All the institutions mentioned have their own publications such as annual reports, monographs on specific topics, informative bulletins, technical bulletins, and in addition, publish articles in the magazines: "Agricultura de El Salvador (Agriculture in El Salvador), "Agricultura Salvadoreña" (Salvadoran Agriculture) SIADES, a magazine of the Society of Agricultural Engineers of El Salvador, "Agrociencias" (Agricultural Sciences), a publication of the School of Agricultural Sciences (the second number is now being printed), "Raza Pura" (Pure Breed), a magazine published by the Ministry of Agriculture and Livestock, and a privately owned magazine, "El Agro Salvadoreño" (The Agricultural Environment in El Salvador).

8. General Limitations in Agricultural Research

Research institutions many times see their studies brought to a halt due to a lack or shortage of installations and equipment, laboratories, libraries, financial and human resources, etc.

The situation in El Salvador is the following:

8.1 Laboratories

- The CENTA Laboratory is a good one which fulfills this institution's needs.

- The laboratory at the university is of limited capacity and, given the political situation, is deficient in terms of the collaboration that it is able to lend to other centers.

- Private enterprise has several laboratories dedicated to the quality control of its products. These are not accessible to other research institutions.

- The laboratory of the General Office of Livestock attempts to serve all divisions, doing so with a great deal of deficiency due to its limited capacity.

- INCAP in Guatemala has a very complete laboratory and lends its services to CEDA-Izalco. However, due to distance and time which must be destined to obtaining results, the researcher is not permitted immediate verification and necessary adjustments in the research process.

8.2 Human Resources

There exists difficulty in training, contracting and maintaining suitable qualified personnel due to the low scale of salaries offered by the institutions mentioned.

8.3 Financial Resources

A shortage of financial resources does not permit the development of required projects: the training of personnel, participation in or the development of seminars and national and international events which encourage an exchange of experiences and knowledge concerning new advances in the field of research; the adaptation and updating of libraries, etc.

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INTERVIEWS

At the Centre for Agricultural Development - CEDA-Izalco with:

Mr. Juan Manuel Menjibar
Advisor

Dr. Luis Alfonso Silva
Director

At the Coffee Research Institute of El Salvador - ISIC with:

Mr. Carlos H. Olano Moreira

At the General Office of Livestock with:

Mr. Jeus Marquez Ochoa
Sub-director

At the Ministry of Planning with:

Mr. Hernan Tenorio
Director of the Department of Agricultural Planning

At the School of Agronomy with:

Mr. Ricardo Leon Esperanza
Sub-Director of the Department of Research

At the Office of Renewable Natural Resources with:

Dr. Jose Cabrero
General Director

At the National Centre of Agricultural Technology with:

Mr. Mario Apontes Martinez
General Sub-Director